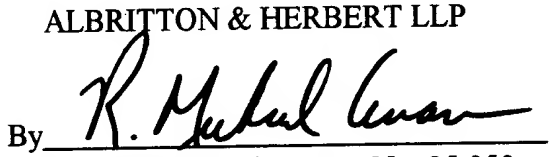
REMARKS

This PRELIMINARY AMENDMENT is submitted prior to the first Office Action and entry is respectfully requested. Please charge any fees associated with this PRELIMINARY AMENDMENT, including any fees for added claims not already paid for, to Deposit Account 06-1300 (Order No. A-69888/RMA).

Respectfully submitted,

FLEHR HOHBACH TEST
ALBRITTON & HERBERT LLP

By 
R. Michael Ananian, Reg. No. 35,050

4 Embarcadero Center Suite 3400
San Francisco, CA 94111
(415) 781-1989
1041639_PA

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

1. (Amended) An apparatus for at least a four-axis alignment of ~~[aligning]~~ an optical fiber with a light source, comprising:

a fiber holder; and

~~[a heat sink; and]~~

a substantially tubular interface having a central axis along its center~~[,]~~ and a first open end ~~[and a second open end]~~, the interface receiving the fiber holder through the first open end and allowing at least a four-axis alignment through a single contact region ~~and the heat sink through the second open end~~, the fiber holder receiving ~~[an]~~ the optical fiber and aligning the optical fiber with the central axis.

2. (Unchanged) The apparatus of Claim 1, further comprising a light source aligned with the central axis, the light source placed within the interface between the heat sink and the fiber holder.

3. (Unchanged) The apparatus of Claim 2, wherein the light source comprises a laser diode.

4. (Unchanged) The apparatus of Claim 3, wherein the laser diode includes a connection by which the laser diode receives power, the interface including an aperture through which the electrode connects the laser diode to a power source.

5. (Unchanged) The apparatus of Claim 1, further comprising a lens aligned perpendicular to the central axis, the lens placed between the heat sink and the fiber holder.

6. (Unchanged) The apparatus of Claim 5, further comprising a lens and a lens holder, the lens holder placed around the lens and fixed to an inner surface of the interface.

7. (Unchanged) The apparatus of Claim 1, wherein the fiber holder includes a substantially spherical portion having a center and a channel of sufficient dimension to receive the optical fiber, the channel located through the center of the substantially spherical portion of the fiber holder.

8. (Amended) The apparatus of Claim 7, wherein the [~~optics tube~~] fiber holder comprises an annular groove around the circumference of the spherical portion, the annular groove holding bonding material that secures the fiber holder to the interface when the fiber holder is brought into contact with the interface.

9. (Unchanged) The apparatus of Claim 7, wherein the fiber holder comprises at least one capillary gap, the capillary gap holding bonding material that secures the fiber holder to the interface when the fiber holder is brought into contact with the interface.

10. (Unchanged) The apparatus of Claim 1, wherein the fiber holder comprises a substantially spherical member and a substantially cylindrical member, the spherical member and cylindrical member having respective central axes, and a channel of sufficient diameter to receive the optical fiber is located along the respective central axes.

11. (Unchanged) The apparatus of Claim 1, wherein the fiber holder comprises a substantially spherical portion having a center and a channel of sufficient dimension to receive the optical fiber, the channel located through the center of the substantially spherical member.

12. (Amended) The apparatus of Claim 1, wherein the fiber holder is secured to the interface by a radial press interference fit.

13. (Amended) The apparatus of Claim 12, wherein the interface is distended by the insertion of the fiber holder to provide a radial press interference fit.

14. (Unchanged) The apparatus of Claim 1, wherein the fiber holder is secured to the interface by polymeric bonding.

15. (Unchanged) The apparatus of Claim 1, wherein the fiber holder is welded in place inside the interface.

16. (Unchanged) The apparatus of Claim 1, wherein the fiber holder has a non-circular profile to provide discrete contact points between the fiber holder and the interface.

17. (Amended) The apparatus of Claim 1, further comprising:

a heat sink;

the interface further having a second open end and receiving the heat sink through the second open end, wherein the heat sink is secured to the interface by polymeric bonding.

18. (Unchanged) The apparatus of Claim 17 wherein the heat sink has a cylindrical shape and comprises a plurality of bores that contain polymeric bonding material that secures the heat sink to the interface when the heat sink is brought into contact with the interface.

19. (Unchanged) The apparatus of Claim 17, wherein the heat sink comprises at least one capillary gap, the capillary gap holding bonding material that secures the heat sink to the interface when the heat sink is brought into contact with the interface.

20. (Amended) The apparatus of Claim 1, further comprising:

a heat sink;

the interface further having a second open end and receiving the heat sink through the second open end, wherein the heat sink is welded in place inside the interface.

21. (Amended) The apparatus of Claim 1, further comprising:

a heat sink;

the interface further having a second open end and receiving the heat sink through the second open end, wherein the heat sink is press fit inside the interface.

22. (Amended) The apparatus of Claim 1, further comprising:

a heat sink;

the interface further having a second open end and receiving the heat sink through the second open end, wherein the fiber holder, heat sink, and interface are secured to a clamping block.

23. (Unchanged) The apparatus of Claim 22, wherein the clamping block encloses the fiber holder, heat sink, and interface.

24. (Unchanged) The apparatus of Claim 22, wherein the fiber holder, heat sink, and interface are strapped on top of the clamping block.

25. (Unchanged) The apparatus of Claim 1, wherein the interface includes access slots allowing access for aligning the fiber holder inside the interface.

26. (Amended) An interface structure for aligning and holding in alignment a laser diode with an optical fiber tip, the interface having ~~[a substantially cylindrical shape having]~~ a central axis of rotation and allowing at least a four-axis alignment through a single contact region, a first open end ~~[suitable]~~ dimensioned to receive a fiber tip holder and to achieve a radially extending interference press fit that retains an end portion of the optical fiber, and a second open end suitably dimensioned to receive a heat sink and laser diode such that the laser diode and fiber holder are retained substantially in alignment with the central axis.

27. (Amended) The interface structure of Claim 26, wherein the interface has a substantially cylindrical structure and said cylindrical shape of the structure comprises a center portion, wherein the center portion distends to receive the fiber holder in a press fit.

28. (Unchanged) The interface structure of Claim 27, wherein the center portion is slightly deformed to a have a noncircular cross section.

29. (Unchanged) The interface structure of Claim 26, further comprising a plurality of access slots located proximate to the first end and extending parallel to the central axis.

30. (Unchanged) The interface structure of Claim 26, further comprising an access slot located proximate to the second end to provide access for an electrode to be attached to the laser diode.

31. (Unchanged) A fiber holder, comprising a substantially spherical body having a central channel extending through the body from one side and terminating on a side opposite the one side, such that the channel is suitably dimensioned to receive an optical fiber having a tip and holding the tip in a fixed position.

32. (Unchanged) The fiber holder of Claim 31, wherein the central channel is tapered to a reduced diameter at the side opposite.

33. (Unchanged) The fiber holder of Claim 31, wherein the spherical body is truncated to provide a flat surface on the side opposite, such that when the optical fiber is inserted in the fiber holder the tip is flush with the flat surface.

34. (Unchanged) The fiber holder of Claim 31, further comprising a substantially cylindrical body having a second central channel, the cylindrical body located proximate to the spherical body such that the central channel of the spherical body is aligned with the second central channel.

35. (Unchanged) The fiber holder of Claim 34, wherein the cylindrical body is attached to the spherical body.

36. (Unchanged) The fiber holder of Claim 34, wherein the spherical body and the cylindrical body are integrated into a single piece.

37. (Amended) A method for aligning a light source with an optical fiber having a tip <u>in at least four different axis</u> such that when light is emitted from the light source the light is transmitted to the tip of the optical fiber, the method comprising:

placing the tip of the optical fiber in an optical fiber holder of suitable dimension to fit within a substantially tubular member having a central axis;

inserting the optical fiber holder and optical fiber within the tubular member;

inserting the light source within the tubular member such that the light source is located proximate to the tip of the optical fiber;

manipulating the tip in any combination of at least a four-axis alignment through a single contact region to position~~[ing]~~ the tip to be in substantial alignment with the central axis; and

manipulating the tip in any combination of at least a four-axis alignment through a single contact region to position~~[ing]~~ the light source to be in substantial alignment with the central axis, such that the tip and the light source are facing each other.

38. (Unchanged) The method of Claim 37, further comprising attaching a heat sink to the light source.

39. (Amended) The method of Claim 38, wherein inserting the light source within the tubular member comprises press fitting the heat sink carrying the light source to the tubular member .

40. (Amended) The method of Claim 37, wherein inserting the fiber holder within the tubular member comprises press fitting the fiber holder into the tubular member to create a radial interference fit.

41. (Unchanged) The method of Claim 37, wherein inserting the fiber holder within the tubular member further comprises welding the fiber holder to the tubular member.

42. (Unchanged) The method of Claim 37, wherein inserting the fiber holder within the tubular member further comprises bonding the fiber holder to the tubular member.

43. (Unchanged) The method of Claim 37, wherein inserting the heat sink within the tubular member further comprises welding the heat sink to the tubular member.

44. (Unchanged) The method of Claim 37, wherein inserting the heat sink within the tubular member further comprises bonding the heat sink to the tubular member.

45. (Unchanged) The method of Claim 38, further comprising placing the tubular member, light source, optical fiber, and heat sink in a clamping block.

46. (Amended) An apparatus for actively aligning an optical fiber with a light source relative to any one or combination of four-axis, comprising:

a fiber holder having a substantially spherical portion having a center and a channel of sufficient dimension to receive a tip at an end of the optical fiber, the channel located through the center of the substantially spherical portion of the fiber holder;

a heat sink;

a substantially tubular interface having a central axis along its center, a first open end and a second open end, the interface receiving the fiber holder through the first open end and creating a radially directed interference press fit with the fiber holder and receiving the heat sink through the second open end, the fiber holder receiving and holding an optical fiber and aligning the optical fiber with the central axis; and

a laser diode aligned with the central axis and placed within the interface between the heat sink and the fiber holder, the laser diode attached to the heat sink such that heat generated from operation of the laser diode is drawn by the heat sink.

Add Claims 47 - 63 as follows:

--47. (New) The apparatus of claim 1, wherein the interface allows a four-axis alignment to an arbitrary level of accuracy through a single contact region.

48. (New) The apparatus of claim 1, wherein the interface allows a six-axis alignment to an arbitrary level of accuracy through a single contact region.

49. (New) The apparatus of claim 1, wherein the at least four-axis alignment includes x-axis, y-axis, and z-axis translation, and θ-angular rotation.

50. (New) The apparatus of claim 1, wherein the alignment comprises an active alignment for achieving a position tolerance smaller than a machined tolerance of the fibre holder and the interface.

51. (New) The apparatus of claim 1, further comprising a heat sink and wherein the interface further having a second open end and receiving the heat sink through the second open end.

52. (New) The apparatus of Claim 1, wherein the fiber holder is secured to and aligned with the interface along an x-axis and a y-axis by a radial press interference fit.

53. (New) The apparatus of Claim 1, wherein the polymeric bonding comprises wicking an inorganic polymeric bonding material between said fiber holder and said interface and hardening said polymeric bonding material to lock said aligned structure.

54. (New) The apparatus of Claim 1, wherein the polymeric bonding comprises an organic polymer.

55. (New) The apparatus of Claim 1, wherein the polymeric bonding comprises an inorganic polymer.

56. (New) An interface structure as in claim 26, wherein the interface has a substantially cylindrical shape.

57. (New) An interface structure as in claim 26, wherein the interface has a substantially non-cylindrical shape.

58. (New) The interface structure of claim 26, wherein the interface structure allows a four-axis alignment to an arbitrary level of accuracy through a single contact region.

59. (New) The interface structure of claim 26, wherein the interface structure allows a six-axis alignment to an arbitrary level of accuracy through a single contact region.

60. (New) The interface structure of claim 26, wherein the at least four-axis alignment includes x-axis, y-axis, and z-axis translation, and θ-angular rotation.

61. (New) The interface structure of claim 26, wherein the alignment comprises an active alignment for achieving a position tolerance smaller than a machined tolerance of the fibre holder and the interface.

62. (New) The interface structure of Claim 26, wherein at least some of said plurality of access slots provide aperture for applying adhesive to secure an aligned assembly.

63. (New) The interface structure of Claim 26, further comprising an access slot located proximate to the second end to provide access for a radially extending electrode to be attached to the laser diode and provide a low-height assembly.–

PENDING CLAIMS

1. An apparatus for at least a four-axis alignment of an optical fiber with a light source, comprising:

a fiber holder; and

a substantially tubular interface having a central axis along its center and a first open end, the interface receiving the fiber holder through the first open end and allowing at least a four-axis alignment through a single contact region, the fiber holder receiving the optical fiber and aligning the optical fiber with the central axis.

2. The apparatus of Claim 1, further comprising a light source aligned with the central axis, the light source placed within the interface between the heat sink and the fiber holder.

3. The apparatus of Claim 2, wherein the light source comprises a laser diode.

4. The apparatus of Claim 3, wherein the laser diode includes a connection by which the laser diode receives power, the interface including an aperture through which the electrode connects the laser diode to a power source.

5. The apparatus of Claim 1, further comprising a lens aligned perpendicular to the central axis, the lens placed between the heat sink and the fiber holder.

6. The apparatus of Claim 5, further comprising a lens and a lens holder, the lens holder placed around the lens and fixed to an inner surface of the interface.

7. The apparatus of Claim 1, wherein the fiber holder includes a substantially spherical portion having a center and a channel of sufficient dimension to receive the optical fiber, the channel located through the center of the substantially spherical portion of the fiber holder.

8. The apparatus of Claim 7, wherein the fiber holder comprises an annular groove around the circumference of the spherical portion, the annular groove holding bonding material that secures the fiber holder to the interface when the fiber holder is brought into contact with the interface.

9. The apparatus of Claim 7, wherein the fiber holder comprises at least one capillary gap, the capillary gap holding bonding material that secures the fiber holder to the interface when the fiber holder is brought into contact with the interface.

10. The apparatus of Claim 1, wherein the fiber holder comprises a substantially spherical member and a substantially cylindrical member, the spherical member and cylindrical member having respective central axes, and a channel of sufficient diameter to receive the optical fiber is located along the respective central axes.

11. The apparatus of Claim 1, wherein the fiber holder comprises a substantially spherical portion having a center and a channel of sufficient dimension to receive the optical fiber, the channel located through the center of the substantially spherical member.

12. The apparatus of Claim 1, wherein the fiber holder is secured to the interface by a radial press interference fit.

13. The apparatus of Claim 12, wherein the interface is distended by the insertion of the fiber holder to provide a radial press interference fit.

14. The apparatus of Claim 1, wherein the fiber holder is secured to the interface by polymeric bonding.

15. The apparatus of Claim 1, wherein the fiber holder is welded in place inside the interface.

16. The apparatus of Claim 1, wherein the fiber holder has a non-circular profile to provide discrete contact points between the fiber holder and the interface.

17. The apparatus of Claim 1, further comprising:

a heat sink;

the interface further having a second open end and receiving the heat sink through the second open end, wherein the heat sink is secured to the interface by polymeric bonding.

18. The apparatus of Claim 17 wherein the heat sink has a cylindrical shape and comprises a plurality of bores that contain polymeric bonding material that secures the heat sink to the interface when the heat sink is brought into contact with the interface.

19. The apparatus of Claim 17, wherein the heat sink comprises at least one capillary gap, the capillary gap holding bonding material that secures the heat sink to the interface when the heat sink is brought into contact with the interface.

20. The apparatus of Claim 1, further comprising:

a heat sink;

the interface further having a second open end and receiving the heat sink through the second open end, wherein the heat sink is welded in place inside the interface.

21. The apparatus of Claim 1, further comprising:

a heat sink;

the interface further having a second open end and receiving the heat sink through the second open end, wherein the heat sink is press fit inside the interface.

22. The apparatus of Claim 1, further comprising:

a heat sink;

the interface further having a second open end and receiving the heat sink through the second open end, wherein the fiber holder, heat sink, and interface are secured to a clamping block.

23. The apparatus of Claim 22, wherein the clamping block encloses the fiber holder, heat sink, and interface.

24. The apparatus of Claim 22, wherein the fiber holder, heat sink, and interface are strapped on top of the clamping block.

25. The apparatus of Claim 1, wherein the interface includes access slots allowing access for aligning the fiber holder inside the interface.

26. An interface structure for aligning and holding in alignment a laser diode with an optical fiber tip, the interface having a central axis of rotation and allowing at least a four-axis alignment through a single contact region, a first open end dimensioned to receive a fiber tip holder and to

achieve a radially extending interference press fit that retains an end portion of the optical fiber, and a second open end suitably dimensioned to receive a heat sink and laser diode such that the laser diode and fiber holder are retained substantially in alignment with the central axis.

27. The interface structure of Claim 26, wherein the interface has a substantially cylindrical structure and said cylindrical shape of the structure comprises a center portion, wherein the center portion distends to receive the fiber holder in a press fit.

28. The interface structure of Claim 27, wherein the center portion is slightly deformed to a have a noncircular cross section.

29. The interface structure of Claim 26, further comprising a plurality of access slots located proximate to the first end and extending parallel to the central axis.

30. The interface structure of Claim 26, further comprising an access slot located proximate to the second end to provide access for an electrode to be attached to the laser diode.

31. A fiber holder, comprising a substantially spherical body having a central channel extending through the body from one side and terminating on a side opposite the one side, such that the channel is suitably dimensioned to receive an optical fiber having a tip and holding the tip in a fixed position.

32. The fiber holder of Claim 31, wherein the central channel is tapered to a reduced diameter at the side opposite.

33. The fiber holder of Claim 31, wherein the spherical body is truncated to provide a flat surface on the side opposite, such that when the optical fiber is inserted in the fiber holder the tip is flush with the flat surface.

34. The fiber holder of Claim 31, further comprising a substantially cylindrical body having a second central channel, the cylindrical body located proximate to the spherical body such that the central channel of the spherical body is aligned with the second central channel.

35. The fiber holder of Claim 34, wherein the cylindrical body is attached to the spherical body.

36. The fiber holder of Claim 34, wherein the spherical body and the cylindrical body are integrated into a single piece.

37. A method for aligning a light source with an optical fiber having a tip in at least four different axis such that when light is emitted from the light source the light is transmitted to the tip of the optical fiber, the method comprising:

placing the tip of the optical fiber in an optical fiber holder of suitable dimension to fit within a substantially tubular member having a central axis;

inserting the optical fiber holder and optical fiber within the tubular member;

inserting the light source within the tubular member such that the light source is located proximate to the tip of the optical fiber;

manipulating the tip in any combination of at least a four-axis alignment through a single contact region to position the tip to be in substantial alignment with the central axis; and

manipulating the tip in any combination of at least a four-axis alignment through a single contact region to position the light source to be in substantial alignment with the central axis, such that the tip and the light source are facing each other.

38. The method of Claim 37, further comprising attaching a heat sink to the light source.

39. The method of Claim 38, wherein inserting the light source within the tubular member comprises press fitting the heat sink carrying the light source to the tubular member .

40. The method of Claim 37, wherein inserting the fiber holder within the tubular member comprises press fitting the fiber holder into the tubular member to create a radial interference fit.

41. The method of Claim 37, wherein inserting the fiber holder within the tubular member further comprises welding the fiber holder to the tubular member.

42. The method of Claim 37, wherein inserting the fiber holder within the tubular member further comprises bonding the fiber holder to the tubular member.

43. The method of Claim 37, wherein inserting the heat sink within the tubular member further comprises welding the heat sink to the tubular member.

44. The method of Claim 37, wherein inserting the heat sink within the tubular member further comprises bonding the heat sink to the tubular member.

45. The method of Claim 38, further comprising placing the tubular member, light source, optical fiber, and heat sink in a clamping block.

46. An apparatus for actively aligning an optical fiber with a light source relative to any one or combination of four-axis, comprising:

a fiber holder having a substantially spherical portion having a center and a channel of sufficient dimension to receive a tip at an end of the optical fiber, the channel located through the center of the substantially spherical portion of the fiber holder;

a heat sink;

a substantially tubular interface having a central axis along its center, a first open end and a second open end, the interface receiving the fiber holder through the first open end and creating a radially directed interference press fit with the fiber holder and receiving the heat sink through the second open end, the fiber holder receiving and holding an optical fiber and aligning the optical fiber with the central axis; and

a laser diode aligned with the central axis and placed within the interface between the heat sink and the fiber holder, the laser diode attached to the heat sink such that heat generated from operation of the laser diode is drawn by the heat sink.

47. The apparatus of claim 1, wherein the interface allows a four-axis alignment to an arbitrary level of accuracy through a single contact region.

48. The apparatus of claim 1, wherein the interface allows a six-axis alignment to an arbitrary level of accuracy through a single contact region.

49. The apparatus of claim 1, wherein the at least four-axis alignment includes x-axis, y-axis, and z-axis translation, and θ-angular rotation.

50. The apparatus of claim 1, wherein the alignment comprises an active alignment for achieving a position tolerance smaller than a machined tolerance of the fibre holder and the interface.

51. The apparatus of claim 1, further comprising a heat sink and wherein the interface further having a second open end and receiving the heat sink through the second open end.

52. The apparatus of Claim 1, wherein the fiber holder is secured to and aligned with the interface along an x-axis and a y-axis by a radial press interference fit.

53. The apparatus of Claim 1, wherein the polymeric bonding comprises wicking an inorganic polymeric bonding material between said fiber holder and said interface and hardening said polymeric bonding material to lock said aligned structure.

54. The apparatus of Claim 1, wherein the polymeric bonding comprises an organic polymer.

55. The apparatus of Claim 1, wherein the polymeric bonding comprises an inorganic polymer.

56. An interface structure as in claim 26, wherein the interface has a substantially cylindrical shape.

57. An interface structure as in claim 26, wherein the interface has a substantially non-cylindrical shape.

58. The interface structure of claim 26, wherein the interface structure allows a four-axis alignment to an arbitrary level of accuracy through a single contact region.

59. The interface structure of claim 26, wherein the interface structure allows a six-axis alignment to an arbitrary level of accuracy through a single contact region.

60. The interface structure of claim 26, wherein the at least four-axis alignment includes x-axis, y-axis, and z-axis translation, and θ-angular rotation.

61. The interface structure of claim 26, wherein the alignment comprises an active alignment for achieving a position tolerance smaller than a machined tolerance of the fibre holder and the interface.

62. The interface structure of Claim 26, wherein at least some of said plurality of access slots provide aperture for applying adhesive to secure an aligned assembly.

63. The interface structure of Claim 26, further comprising an access slot located proximate to the second end to provide access for a radially extending electrode to be attached to the laser diode and provide a low-height assembly.